THE PRESIDIO TRUST

9 April 2008

Mr. Bob Boggs
California Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2721

Subject: Field Sampling Plan for the Machine Gun Butt, dated April 2008
Presidio of San Francisco, California

Dear Mr. Boggs:

Enclosed please find one hard copy and one electronic copy of the *Field Sampling Plan (FSP) for the Machine Gun Butt, Presidio of San Francisco, California* prepared by EKI for the Presidio Trust (Trust). This FSP proposes additional soil sampling at the Machine Gun Butt (MGB) site to address data gaps necessary to proceed with the Remedial Action Plan (RAP) for the site. The Trust plans to perform field work during the week of April 21, 2008.

Please contact me at (415) 561-4293 or Eileen Fanelli at (415) 561-4259 if you have any questions.

Sincerely yours,
The Presidio Trust

Genevieve Coyle

Genevieve Coyle
Environmental Remediation Project Manager

Enclosure

Cc (with enclosure):
Agnes Farres, Water Board
Brian Ullensvang, NPS
Doug Kern, Presidio RAB
Mark Youngkin, RAB (cover letter only)

Erler & Kalinowski, Inc.
Consulting Engineers and Scientists
1870 Ogden Drive
Burlingame, CA 94010
(650) 292-9100
Fax (650) 552-9012

9 April 2008

Ms. Genevieve Coyle
The Presidio Trust
Building 67
P.O. Box 29052
San Francisco, CA 94129-0052

Subject: **Field Sampling Plan for the Machine Gun Butt**
Presidio of San Francisco, California
(EKI A70004.11)

Dear Ms. Coyle:

On behalf of the Presidio Trust ("Trust"), Erler & Kalinowski, Inc. ("EKI") has prepared this Field Sampling Plan ("FSP") for shallow soil sampling and chemical analysis from eight locations at the former Machine Gun Butt site ("MGB"). The MGB is located within the Crissy Field Planning District, and was addressed in the *Presidio Draft Small Arms Firing Ranges Feasibility Study Report* ("SAFRFS"), dated November 2004 (Treadwell & Rollo, 2004). The results of soil sampling and chemical analysis described herein will be used to assess whether potential chemicals of concern ("COCs") previously detected in shallow soil at the MGB are actually present at levels that warrant remedial action.

The scope and objectives of the MGB FSP were developed in consultation with the Trust and the National Park Service ("NPS"), the Department of Toxic Substances Control ("DTSC"), and members of the Restoration Advisory Board ("RAB"). Collectively, these parties are referred to as the "stakeholders." The scope of work will be conducted in accordance with the Presidio-wide Quality Assurance Project Plan ("QAPP") (TTEMI, 2001).

BACKGROUND

The MGB is located in Area B, at Crissy Field south of former Building 637 (Figure 1). The MGB was used as a firing range during the late 1930s and early 1940s. Historically, the MGB was designated as Structure 635 and encompassed an area of approximately 50 feet by 50 feet.[1] According to Montgomery Watson (1997), the site was used to fire machine guns from a position north of the slope south towards targets placed at the base

[1] Although Montgomery Watson (1997) states the area is 50 feet by 50 feet, the site map in the document has dimensions of 20 feet by 40 feet. The firing range boundary from Montgomery Watson (1997) is used as the basis for Figure 1.

of the slope. The bedrock slope may have served as a backstop, or berms could also have been constructed in front of the hillside.

A motor pool area was constructed at the site following its use as a firing range. The motor pool area included several above ground storage tanks ("ASTs"). In 1993, the ASTs and associated piping were removed, and soil impacted with petroleum hydrocarbons was excavated from the site. Soil was removed from beneath the ASTs and pump islands to approximately 18 inches below ground surface ("bgs"). The Army performed additional excavation for petroleum impacts northwest of the AST area in 1993 (Montgomery Watson, 1997). In 1999, in accordance with the Building 637 Corrective Action Plan (Presidio Trust, 1999), the Building 637 Area underwent an additional removal action to address petroleum contaminated groundwater and soil. Removal activities included excavation of contaminated vadose zone soil from the site, treatment of residual hydrocarbons in the smear zone, and establishing a monitoring well network to monitor contaminated groundwater. Soil sampling activities associated with the tank removals near the MGB did not include metals analyses. Soil samples were only tested for petroleum hydrocarbons and related constituents. In addition, the primary excavation activities occurred north and northwest of the MGB. The removal action was documented in the Building 637 Completion Report (Presidio Trust, 2000).

Current cleanup levels at the MGB are based on recreational human land use and buffer zone ecological land use. Serpentinite and beach/dune are the predominant soil lithologies, although the SAFRFS (Treadwell & Rollo, 2004) indicated that some Colma lithology was identified in some samples collected by the Army.

Prior to 1996, environmental investigations in the MGB area had only focused on the petroleum storage related to the motor pool. In 1996, the Army investigated former firing ranges and collected soil samples from 13 locations at the MGB (sample locations 637BR60 through 637BR72 on Figure 1). Samples 637BR60 through 637BR65 were inadvertently collected outside the area of the firing range's impact berm. Therefore, the Army returned and collected samples from locations 637BR66 through 637BR72 (Montgomery Watson, 1997). Samples were analyzed for the metals antimony, barium, copper, lead, and zinc using energy dispersive X-ray fluorescence ("XRF") as a field screening tool to assess whether additional sampling was required to define the horizontal and vertical extents of chemical impact. The Army reportedly sent 20 percent of the samples to a fixed laboratory for U.S. EPA Method 6010 analysis for lead to confirm the lead XRF data (Montgomery Watson, 1997).[2] A copy of the data table from the Army's report is included in Appendix A.

[2] No fixed laboratory confirmation samples were analyzed for samples 637BR60 through 637BR65, the samples inadvertently collected outside the firing range's impact berm by the Army.

The Army found one bullet at location 637BR66, where the 0.3 ft bgs sample had a lead concentration of 340 mg/kg (measured by XRF).[3] The lead concentration measured in this sample by U.S. EPA Method 6010 was 303 mg/kg. The lead concentration in soil from a 1.0 ft bgs sample from this sample location was 84 mg/kg. Because the lead concentration was below the Army's screening concentration of 477 mg/kg, the Army recommended no further action for the MGB site (Montgomery Watson, 1997).

Although the maximum concentration of zinc detected in shallow soil, as measured by XRF, was 1,100 mg/kg (0.3 ft bgs at 637BR70), the Army did not attribute the elevated levels to firing range activities, and evaluated further remedial action on the basis of lead (Montgomery Watson, 1997). Of the 24 zinc analyses reported by Montgomery Watson, the zinc concentration in 17 of the samples exceeded the current site-specific, ecological buffer zone cleanup level for Beach/Dune lithology of 60 mg/kg (Appendix A). The zinc concentration in 6 soil samples exceeded 160 mg/kg, the site-specific zinc cleanup level for serpentinite lithology. The samples containing zinc concentrations over 160 mg/kg did not have lead greater than 72 mg/kg, supporting the Army's conclusion that the zinc may not be related to the firing range usage. In addition, the elevated zinc measured by the Army may be an artifact of the XRF analysis, rather than actual impact. However, the Army did not perform laboratory analyses for zinc to verify the XRF results.

In July 2003, the Trust collected 34 soil samples from 18 locations as part of the Small Arms Firing Ranges remedial investigation (Treadwell & Rollo, 2004). The Trust sample locations are shown on Figure 1. The Trust samples were spread in a grid pattern over the hillside that may have been used as the machine gun backstop. The Trust soil samples were analyzed by US EPA Method 6010 or 6020; the resulting data are included in Appendix A. The maximum concentration of lead detected in the samples was 200 mg/kg, below the current ecological buffer zone cleanup level of 300 mg/kg.

The soil lithologies identified in the boring logs of the Trust's investigation indicated mostly Colma and beach/dune as the soil type, with some references to serpentinite gravel or sand with serpentinite (Treadwell & Rollo, 2004). The Trust identified two soil sample locations with zinc detected above the Colma background concentration of 60 mg/kg, MGBSB04 and MGBSB19 (boring logs indicate both of these samples were collected from Colma lithology). At location MGBSB04, zinc was detected slightly above the background concentration in the 1 ft bgs sample and the 1.5 ft bgs duplicate at concentrations of 63 and 64 mg/kg, respectively, but was detected at 57 mg/kg (below the cleanup level of 60 mg/kg) in the 2 ft bgs sample at the same location. At MGBSB19, zinc was detected in the shallow soil sample (0.3 ft bgs) at a concentration of at 76 mg/kg, but bedrock was encountered before a deeper soil could be collected. The Trust's sampling in 2003 did not confirm the earlier results of elevated zinc concentrations detected by the Army.

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[3] This sample is the only one where lead has historically been detected above the current 300 mg/kg cleanup level for ecological buffer zone sites.

The Trust sampling locations did not coincide with the locations of the previous Army sample results. The extent of the elevated zinc concentrations detected by the Army's XRF results (up to 1,100 mg/kg) was not resolved by the Trust's 2003 investigation. This FSP addresses the data gap surrounding the Army's elevated detections of zinc at the MGB site.

DATA QUALITY OBJECTIVES

The data quality objectives ("DQOs") for this FSP Addendum are summarized in Table 1. The DQOs are designed to guide the collection of the additional data needed to evaluate the nature and extent of zinc and lead at the MGB site. Specifically, soil samples will be collected from locations of the previous Army samples, and analyzed in a fixed laboratory. The DQOs identify the decisions that will be made in the investigation process.

As described in Table 1 and shown on Figure 1, a total of up to 8 new soil borings are proposed at the MGB in locations previously sampled by the Army to evaluate lead and zinc concentrations in soil samples. Field notes will be used to identify observed lithology, and analysis for chromium, nickel, and cobalt in the soil samples will be used to assist in the chemical identification of the sample lithology. The results of the sampling event will be used to evaluate the need for potential remedial actions at the MGB.

FIELD ACTIVITIES

General Field Activities

Prior to field activities, EKI will update its site specific health and safety plan, and prepare a subcontract with the California licensed surveyor and contact Underground Service Alert prior to the initiation of subsurface work. The Trust will provide access to sampling locations, including removing any equipment or debris that is currently located over and near planned sample locations. The Trust will also provide its own utility clearance.

To ensure that the sample data can confirm or refute previous Army data, the new Trust samples will be collected at the same points as previous Army sample locations. As Army sample location survey coordinates are not available, a State of California-licensed land surveyor will survey the former Army sampling locations based on coordinates derived from EKI's digitizing of the Army sample locations from the Army sampling figure (Montgomery Watson, 1997). The ground surface elevation and the horizontal coordinates of each location will be surveyed. The horizontal coordinates will be reported in NAD 27. The vertical coordinates will be reported in both the North American Vertical Datum 88 ("NAVD 88") as well as 1907 Presidio Lower Low Water

("PLLW") vertical datum. Local benchmarks will be provided by the Trust. Survey data will be used to update maps, and to document sample locations. The Trust, NPS, and DTSC may be present when sampling locations are identified in the field.

In accordance with the QAPP, sample location identification codes are based on "MGB" for Machine Gun Butt, "SB" for soil boring, and sequential numbering starting at 101 (previous Trust samples at MGB started at MGSB01). In keeping with the QAPP, a soil sample from 0.3 feet below ground surface will be designated as MGBSB101[0.3].

EKI will collect soil samples from eight sample locations at the MGB (Figure 1) in accordance with the field methods and procedures outlined in Appendix B and as specified in Standard Operating Procedures ("SOP") SOP 001, SOP 014, and SOP 015 of the QAPP (included as part of Appendix B). The soil samples will be collected using a trowel, shovel, or hand auger, from depths of approximately 0.3 feet bgs and 1 foot bgs from each sampling location. Table 2 summarizes the soil samples to be collected at the MGB.

Upon completion of soil sampling activities, soil removed from the boreholes will be placed back in the hole. Anticipated investigation-derived waste includes containers of decontamination rinse water and plastic bags with used personal protective equipment and non-hazardous trash.

Field Quality Control Samples

Field duplicates will be collected as part of this investigation. A field duplicate is a sample collected at the same time, and from the same source and depth as the associated primary sample. Field duplicate pairs are collected to assess the consistency or precision of the laboratory's analytical system. The QAPP specifies a frequency of 10% for field duplicates; therefore, two field duplicate samples will be collected and submitted to the laboratory for analysis. Field duplicates are anticipated to be collected at MGBSB106[0.3] and MGBSB108[0.3], unless field conditions prevent collection of these duplicate samples. In that case, duplicates will be collected from other sample locations as determined in the field. Duplicates will be marked with "-DUP" at the end of the sample name.

LABORATORY ANALYSIS AND ANALYTICAL METHODS

All samples collected will be submitted to a State-certified analytical laboratory and analyzed by US EPA Method 6020 (ICP/MS) for lead, zinc, chromium, nickel, and cobalt on a standard turnaround time basis. The analytical quality control criteria are provided in the QAPP. Analytical data will be validated in accordance with the QAPP.

If necessary, comparison of concentrations of specific elements on log-probability plots with Presidio-specific background data may be performed to confirm observed lithology.

All samples collected will be submitted to Curtis & Tompkins, a State-certified analytical laboratory, and analyzed by US EPA Method 6020 for lead, zinc, chromium, nickel, and cobalt. Samples will be analyzed on a standard turnaround time.

SCHEDULE

Field work activities will commence upon stakeholder approval of this Field Sampling Plan. It is anticipated that the surveying to locate previous soil sampling locations will be completed in one day. Soil sampling is currently anticipated to be conducted in one day during the week of 21 April 2008. A sampling report will be prepared after receipt of the validated analytical data.

Please contact me at (650) 292-9100 if you have any questions or comments.

Very truly yours,

ERLER & KALINOWSKI, INC.

John T. DeWitt, P.E.
Project Engineer

Attachments

Table 1 – Machine Gun Butt Sampling Data Quality Objectives
Table 2 – Machine Gun Butt Soil Sample Matrix
Figure 1 – Proposed Field Sampling Locations at Machine Gun Butt
Appendix A – Historical Data For Machine Gun Butt
Appendix B – Field Methods and Procedures

References

EKI, 2002. *Development of Presidio-Wide Cleanup Levels for Soil, Sediment, Groundwater, and Surface Water, Presidio of San Francisco, California.* October.

Montgomery Watson. 1997. *Final Site Investigation Report for the Small Arms Firing Ranges, Presidio of San Francisco, California.* July.

Presidio Trust, 2000. *Excavation Report for the Building 637 Area, The Presidio of San Francisco, California.* 22 June 2000.

Presidio Trust, 1999. *Final Corrective Action Plan, Building 637 Area, The Presidio of San Francisco, California.* August.

Tetra Tech, 2001. *Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan, Presidio of San Francisco, California.* April.

Treadwell & Rollo, Inc. 2004. *Draft Small Arms Firing Ranges Remedial Investigation Report, Presidio of San Francisco, California.* February.

TABLE 1
MACHINE GUN BUTT SAMPLING DATA QUALITY OBJECTIVES
Presidio of San Francisco, California

State the Problem	Identify the Decisions	Identify Inputs to the Decisions	Define the Study Boundaries	Develop Decision Rules	Specify Limits on Decision Errors	Optimize the Design
Concentrations of lead and zinc detected in soil samples collected by the Army and the Trust at the Machine Gun Butt ("MGB") exceed site-specific Presidio cleanup levels for these chemicals. Previous sample results from the Army using x-ray fluorescence ("XRF") showed some zinc concentrations were significantly greater than cleanup levels, and other concentrations were only slightly greater than background levels. The presence of elevated concentrations of zinc was not resolved by Trust sampling in 2003. Screening of chemicals of concern in the Small Arms Firing Range Feasibility Study is based on the most conservative lithology observed, which may not be appropriate for the samples with the slightly elevated zinc concentrations.	1. What is the appropriate lithology for determining cleanup levels based on the samples from the MGB? 2. Are zinc and lead concentrations present in soil at concentrations significantly above site-specific cleanup levels? 3. Can previous Army sample results using XRF be confirmed by laboratory analysis?	1. Results of previous chemical analysis of soil samples from the MGB collected by the Army and the Trust. Army data were collected by XRF, which is a field screening method and is considered qualitative. 2. Results of laboratory analyses from this soil resampling event. 3. If necessary, comparison of specific elements on log-probability plots with Presidio-specific background data to determine lithology. 4. Comparison of analytical results with screening threshold concentrations and applicable cleanup levels.	The study boundary for the characterization investigation is the MGB area near former AST 637.3. The area going uphill to the south towards Battery Blaney has already been characterized and is not included in this study area. The boundaries are further limited to the locations of specific previous samples collected by the Army.	Select soil lithology based on field observations, measured concentrations, and comparison with Presidio-specific background data. Select appropriate cleanup levels based on lithological assessment. If concentrations of lead or zinc in soil samples exceed site-specific cleanup levels or screening concentrations based on lithology, the data will be further evaluated (potentially including statistical analysis of site data) to assess whether remedial actions are warranted. If concentrations of lead or zinc in soil samples collected in this sampling event do not exceed site-specific cleanup levels or screening concentrations based on lithology, then the results of the sampling will be documented, and the combination of new and existing data will be used to assess the need for remedial actions.	1. Field, analytical, and data validation procedures will follow the QAPP (Tetra Tech, 2001) to the extent possible. Duplicate soil samples will also be collected per the QAPP. 2. A potential error in evaluation of soil samples would be to incorrectly quantify the chemicals present in soil. The acceptable range of decision error would be a consequence of field and/or analytical errors and will be evaluated during the data validation procedures. 3. A potential error could be to incorrectly locate the previous samples. These points will be surveyed prior to the sampling event.	1. Eight new soil borings (MGBSB101 through MGBSB108) will be installed, as shown on Figure 1. Samples will be collected from 4 and 12 inches below ground surface from each boring. These samples will be analyzed by US EPA Method 6020 for lead and zinc to confirm XRF results, and for chromium, nickel, and cobalt to evaluate lithology. 2. Samples from MGBSB101 through MGBSB103 will be collected from the area west of the MGB to evaluate soil lithology and previous zinc detections slightly above background concentrations. 3. Samples from MGBSB104 through MGBSB108 will be collected to evaluate soil lithology and previous elevated concentrations of lead and zinc measured by the Army in the area of the MGB.

<u>Abbreviation:</u>
QAPP *Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan*, Tetra Tech EM Inc., dated April 2001.

TABLE 2
MACHINE GUN BUTT SOIL SAMPLE MATRIX
Presidio of San Francisco, California

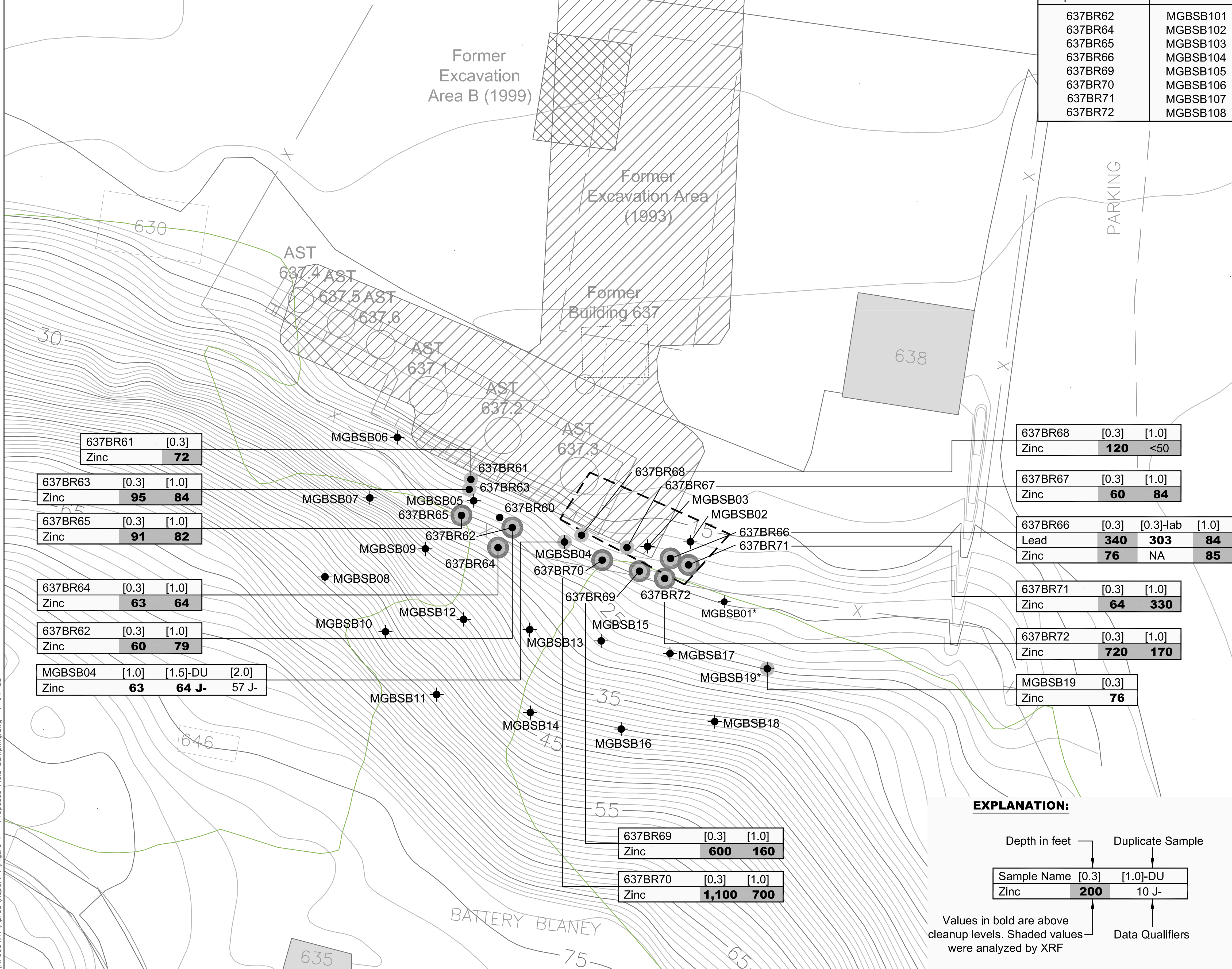
Sample ID	Sample Depth (ft bgs)	Laboratory Analyses
		Lead, Zinc, Chromium, Nickel, Cobalt (EPA 6020)
MGBSB101 (0.3)	0.3	*
MGBSB101 (1.0)	1.0	*
MGBSB102 (0.3)	0.3	*
MGBSB102 (1.0)	1.0	*
MGBSB103 (0.3)	0.3	*
MGBSB103 (1.0)	1.0	*
MGBSB104 (0.3)	0.3	*
MGBSB104 (1.0)	1.0	*
MGBSB105 (0.3)	0.3	*
MGBSB105 (1.0)	1.0	*
MGBSB106 (0.3)	0.3	*
MGBSB106 (1.0)	1.0	*
MGBSB107 (0.3)	0.3	*
MGBSB107 (1.0)	1.0	*
MGBSB108 (0.3)	0.3	*
MGBSB108 (1.0)	1.0	*

Abbreviations:
EPA – United States Environmental Protection Agency
ft bgs – feet below ground surface
QAPP – Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan, Tetra Tech EMI Inc., dated April 2001.
* – Analyze

Notes:
(a) Per QAPP guidance, one duplicate will be collected for every ten samples on each day of field work. Duplicate samples will be noted with "DUP" in the Sample ID.

Soil Cleanup Levels (mg/kg)	
Lead	300
Zinc	60

LOCATIONS TO RESAMPLE	
Existing Army Sample Location ID	Trust Resample Location ID
637BR62	MGBSB101
637BR64	MGBSB102
637BR65	MGBSB103
637BR66	MGBSB104
637BR69	MGBSB105
637BR70	MGBSB106
637BR71	MGBSB107
637BR72	MGBSB108



N

0 30 60

(Approximate Scale in Feet)

Key Map

LEGEND

- Trust 2003 Soil Boring Location
- Army Sample Location
- One or more COCs in samples from this location exceeded a cleanup level
- Army Sample Location to be Resampled
- Firing Range Boundary
- * Subsurface Obstruction Encountered at 10 Inches Below Surface, No Soil Sample Collected Below that Depth

COC Chemical of Concern

mg/kg milligrams per kilogram

NA Not Analyzed

Notes:

1. All locations are approximate.
2. Figure modified from Site Investigation Report for Small Arms Firing Ranges (Montgomery Watson, July 1997) and Draft Small Arms Firing Ranges Feasibility Study Report (Treadwell & Rollo, November 2004).
3. Horizontal Datum: NAD27, CA State Plane Coordinates, Zone 3, feet Vertical Datum: North American Vertical Datum, NAVD88 (topography).
4. Measured metal concentrations of samples with names starting with 637BR (shaded data) were taken using x-ray flourescence ("XRF"), a field measurement tool.
5. Only data from sample locations with XRF or analytical results above cleanup levels are posted. All results are in mg/kg.

Erler & Kalinowski, Inc.

Proposed Field Sampling at Machine Gun Butt

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Presidio Trust
San Francisco, CA
April 2008
EKI A70004.11
Figure 1

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APPENDIX A

HISTORICAL DATA FOR MACHINE GUN BUTT

FINAL

SITE INVESTIGATION REPORT FOR THE SMALL ARMS FIRING RANGES

PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Prepared for:

U. S. Army Corps of Engineers
Sacramento District
Sacramento, California

Prepared by:	Lynn DeGeorge Lynn DeGeorge Project Manager	7-14-97 Date
Approved by:	Greg Little Greg Little, R. G. Supervising Hydrogeologist	7-14-97 Date

REGISTERED GEOLOGIST
GREGORY E. LITTLE
No. 4788
Exp. 1/31/99
STATE OF CALIFORNIA

TABLE E-5
SUMMARY OF DETECTED ANALYTES
MACHINE GUN BUTT SOUTHEAST OF BUILDING 637
PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Sample Location ID:	**637BR60**	**637BR61**	**637BR62**	**637BR62**	**637BR63**	**637BR63**	**637BR64**	**637BR64**
Sample Date:	**2/27/96**	**2/27/96**	**2/27/96**	**2/27/96**	**2/27/96**	**2/27/96**	**2/27/96**	**2/27/96**
Depth (feet):	**0.3**	**0.3**	**0.3**	**1.0**	**0.3**	**1.0**	**0.3**	**1.0**
Metals (mg/kg)								
Lead	NA	NA	NA	NA	NA	NA	NA	NA
XRF Metals (mg/kg)								
Antimony	<50	<50	<50	<50	<50	<50	<50	<50
Barium	**560**	**530**	**520**	**470**	**410**	**430**	**460**	**530**
Copper	<50	<50	<50	<50	<50	<50	<50	<50
Lead	**10**	**15**	**29**	**27**	**67**	**19**	**55**	**24**
Zinc	**59**	**72**	**60**	**79**	**95**	**84**	**63**	**64**

TABLE E-5
SUMMARY OF DETECTED ANALYTES
MACHINE GUN BUTT SOUTHEAST OF BUILDING 637
PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Sample Location ID:	**637BR65**	**637BR65**	**637BR66**	**637BR66**	**637BR67**	**637BR67**	**637BR68**	**637BR68**
Sample Date:	**2/27/96**	**2/27/96**	**3/13/96**	**3/14/96**	**3/14/96**	**3/14/96**	**3/13/96**	**3/14/96**
Depth (feet):	**0.3**	**1.0**	**0.3**	**1.0**	**0.3**	**1.0**	**0.3**	**1.0**
Metals (mg/kg)								
Lead	NA	NA	**303**	NA	NA	NA	**29**	NA
XRF Metals (mg/kg)								
Antimony	<50	<50	<50	<50	<50	<50	<50	<50
Barium	**400**	**420**	**510**	**560**	**610**	**600**	**770**	**540**
Copper	<50	<50	<50	<50	<50	<50	<50	<50
Lead	**92**	**31**	**340**	**84**	**24**	**32**	**51**	**18**
Zinc	**91**	**82**	**76**	**85**	**60**	**84**	**120**	<50

File: TBL. E-5
Date: 7/15/97

TABLE E-5
SUMMARY OF DETECTED ANALYTES
MACHINE GUN BUTT SOUTHEAST OF BUILDING 637
PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Sample Location ID:	**637BR69**	**637BR69**	**637BR70**	**637BR70**	**637BR71**	**637BR71**	**637BR72**	**637BR72**
Sample Date:	**3/13/96**	**3/14/96**	**3/13/96**	**3/14/96**	**3/14/96**	**3/14/96**	**3/14/96**	**3/14/96**
Depth (feet):	**0.3**	**1.0**	**0.3**	**1.0**	**0.3**	**1.0**	**0.3**	**1.0**
Metals (mg/kg)								
Lead	**66**	NA	**29**	NA	NA	NA	NA	NA
XRF Metals (mg/kg)								
Antimony	<50	<50	<50	<50	<50	<50	<50	<50
Barium	**510**	**550**	**530**	**530**	**550**	**530**	**540**	**630**
Copper	<50	<50	<50	<50	<50	<50	<50	<50
Lead	**37**	**72**	**51**	**29**	**13**	**40**	**35**	**18**
Zinc	**600**	**160**	**1,100**	**700**	**64**	**330**	**720**	**170**

THE PRESIDIO TRUST

DRAFT
SMALL ARMS FIRING RANGES
REMEDIAL INVESTIGATION REPORT

PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Prepared For:

The Presidio Trust
34 Graham Street, P.O. Box 29052
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Prepared By:

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555 Montgomery Street, Suite 1300
San Francisco, California 94111
415/955-9040 fax 415/955-9041

February 2004

Dorinda Shipman, R.G., C.HG., Treadwell & Rollo, Inc.

3 February 2004
Date

REGISTERED GEOLOGIST
DORINDA SHIPMAN
CH No. 215
CERTIFIED HYDROGEOLOGIST
STATE OF CALIFORNIA

Table 12
Summary of Metals Results in Soil
Machine Gun Butt
Small Arms Firing Ranges
Presidio of San Francisco, California

			Aluminum (mg/kg)	**Antimony** (mg/kg)	**Arsenic** (mg/kg)	**Barium** (mg/kg)	**Beryllium** (mg/kg)	**Cadmium** (mg/kg)		**Chromium** (mg/kg)	**Cobalt** (mg/kg)	**Copper** (mg/kg)	**Iron** (mg/kg)	**Lead** (mg/kg)	**Magnesium** (mg/kg)	**Manganese** (mg/kg)	**Nickel** (mg/kg)	**Selenium** (mg/kg)	**Silver** (mg/kg)	**Thallium** (mg/kg)	**Vanadium** (mg/kg)	**Zinc** (mg/kg)
		Analytical Method	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020		SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020	SW6010/ 6020
Cleanup Level			**NE**	**5**	**5.4**	**320**	**10**	**0.8**		**120**	**48**	**43**	**NE**	**160**	**NE**	**NE**	**71**	**1.1**	**2**	**1**	**74**	**60**
Sample Name	**Sample Date**	**Sample Depth (feet)**						**ICP**	**ICP/MS**													
MGBSB02[1]	07/22/03	1	NA	< 3.5 UJ	NA	70	NA	NA	NA	NA	NA	15 J-	NA	27	NA	NA	NA	NA	NA	NA	NA	42 J-
MGBSB02[2]	07/22/03	2	NA	< 3.4 UJ	NA	65	NA	NA	NA	NA	NA	16 J-	NA	25	NA	NA	NA	NA	NA	NA	NA	50 J-
MGBSB03[1]	07/22/03	1	NA	< 2.9 R	NA	75	NA	NA	NA	NA	NA	12	NA	15	NA	NA	NA	NA	NA	NA	NA	53 J-
MGBSB03[2]	07/22/03	2	NA	< 2.9 R	NA	82	NA	NA	NA	NA	NA	29	NA	0.59	NA	NA	NA	NA	NA	NA	NA	39 J-
MGBSB04[1]	07/22/03	1	NA	< 2.8 R	NA	94	NA	NA	NA	NA	NA	15	NA	39	NA	NA	NA	NA	NA	NA	NA	**63**
DUP072203A	07/22/03	1.5	NA	< 3 R	NA	150	NA	NA	NA	NA	NA	21	NA	34	NA	NA	NA	NA	NA	NA	NA	**64 J-**
MGBSB04[2]	07/22/03	2	NA	< 3 R	NA	190	NA	NA	NA	NA	NA	25	NA	28	NA	NA	NA	NA	NA	NA	NA	57 J-
MGBSB05[1]	07/22/03	1	NA	< 2.7 R	NA	49	NA	NA	NA	NA	NA	10	NA	29	NA	NA	NA	NA	NA	NA	NA	43
MGBSB05[2]	07/22/03	2	NA	< 2.7 R	NA	58	NA	NA	NA	NA	NA	24	NA	200	NA	NA	NA	NA	NA	NA	NA	33
MGBSB06[1]	07/22/03	1	6,100	< 2.8 R	3	35	0.11	**1.2**	< 0.25	50	7.6	6.6	9,900	15	38,00 J+	190	54	0.34	< 0.23	< 0.23	28	34
MGBSB06[2]	07/22/03	2	NA	< 2.6 R	NA	52	NA	NA	NA	NA	NA	7.7	NA	10	NA	NA	NA	NA	NA	NA	NA	30
MGBSB07[1]	07/22/03	1	NA	< 2.9 UJ	NA	30	NA	NA	NA	NA	NA	5.7 J-	NA	3	NA	NA	NA	NA	NA	NA	NA	20 J-
MGBSB07[2]	07/22/03	2	NA	< 3.2 UJ	NA	21	NA	NA	NA	NA	NA	9 J-	NA	< 0.16	NA	NA	NA	NA	NA	NA	NA	24 J-
MGBSB08[1]	07/22/03	1	NA	< 2.9 UJ	NA	67	NA	NA	NA	NA	NA	6.7 J-	NA	19	NA	NA	NA	NA	NA	NA	NA	23 J-
MGBSB08[2]	07/22/03	2	NA	< 2.8 UJ	NA	12	NA	NA	NA	NA	NA	2.8 J-	NA	0.39	NA	NA	NA	NA	NA	NA	NA	13
MGBSB09[1]	07/22/03	1	NA	< 3.1 UJ	NA	23	NA	NA	NA	NA	NA	5.1 J-	NA	19	NA	NA	NA	NA	NA	NA	NA	24 J-
MGBSB09[2]	07/22/03	2	NA	< 3.1 UJ	NA	16	NA	NA	NA	NA	NA	3 J-	NA	1.6	NA	NA	NA	NA	NA	NA	NA	15 J-
MGBSB10[1]	07/22/03	1	NA	< 3.1 UJ	NA	24	NA	NA	NA	NA	NA	4 J-	NA	6.8	NA	NA	NA	NA	NA	NA	NA	16 J-
MGBSB10[2]	07/22/03	2	NA	< 2.9 UJ	NA	42	NA	NA	NA	NA	NA	6.6 J-	NA	36	NA	NA	NA	NA	NA	NA	NA	29 J-
MGBSB11[1]	07/21/03	1	NA	< 2.8 R	NA	56	NA	NA	NA	NA	NA	9.3	NA	19	NA	NA	NA	NA	NA	NA	NA	28
MGBSB11[2]	07/21/03	2	NA	< 2.4 R	NA	91	NA	NA	NA	NA	NA	13	NA	3.1	NA	NA	NA	NA	NA	NA	NA	30
MGBSB12[1]	07/21/03	1	NA	< 2.6 R	NA	41	NA	NA	NA	NA	NA	8.4	NA	32	NA	NA	NA	NA	NA	NA	NA	29
MGBSB12[2]	07/21/03	2	NA	< 2.6 R	NA	26	NA	NA	NA	NA	NA	4.4	NA	10	NA	NA	NA	NA	NA	NA	NA	23
MGBSB13[1]	07/21/03	1	NA	< 2.7 R	NA	83	NA	NA	NA	NA	NA	13	NA	15	NA	NA	NA	NA	NA	NA	NA	30
MGBSB14[0.5]	07/21/03	0.5	NA	< 2.8 R	NA	110	NA	NA	NA	NA	NA	17	NA	9.9	NA	NA	NA	NA	NA	NA	NA	37
MGBSB14[1]	07/21/03	1	NA	< 2.9 R	NA	79	NA	NA	NA	NA	NA	14	NA	13	NA	NA	NA	NA	NA	NA	NA	28
MGBSB15[1]	07/21/03	1	NA	< 2.8 R	NA	60	NA	NA	NA	NA	NA	9.2	NA	11	NA	NA	NA	NA	NA	NA	NA	33
MGBSB16[1]	07/21/03	1	8,200	< 2.9 R	2.9	89	0.23	**1.7**	< 0.25	55	12	11	15,000	8.5	2,900 J+	340	59	1	< 0.24	< 0.24	40	35
MGBSB16[2]	07/21/03	2	NA	< 2.9 R	NA	71	NA	NA	NA	NA	NA	11	NA	1.4	NA	NA	NA	NA	NA	NA	NA	27
MGBSB17[1]	07/21/03	1	NA	< 2.8 R	NA	95	NA	NA	NA	NA	NA	12	NA	30	NA	NA	NA	NA	NA	NA	NA	41
MGBSB17[2]	07/21/03	2	NA	< 2.9 R	NA	100	NA	NA	NA	NA	NA	11	NA	5.3	NA	NA	NA	NA	NA	NA	NA	36
MGBSB18[1]	07/21/03	1	NA	< 3 R	NA	58	NA	NA	NA	NA	NA	9.1	NA	6.3	NA	NA	NA	NA	NA	NA	NA	25
MGBSB18[2]	07/21/03	2	NA	< 2.6 R	NA	31	NA	NA	NA	NA	NA	4.2	NA	0.29	NA	NA	NA	NA	NA	NA	NA	19
MGBSB19[0.3]	07/21/03	0.3	NA	< 3 R	NA	57	NA	NA	NA	NA	NA	21	NA	120	NA	NA	NA	NA	NA	NA	NA	**76**

Notes
mg/kg - milligrams per kilogram
Dup prefix indicates blind duplicate sample.
ICP - inductively coupled plasma
MS - mass spectrometry
NA - Not analyzed
NE - Not established
BOLD values indicate concentration exceeding cleanup levels.
Cleanup levels were obtained from Table 7-2 of the Cleanup Levels Document (EKI, 2002).
J+ - Data validation qualifier, "The analyte was positively identified; the associated numerical value is biased high due to a high surrogate recovery and should be considered an approximate concentration of the analyte in the sample."
J- - Data validation qualifier, "The analyte was positively identified; the associated numerical values is biased low due to a low surrogate recovery and should be considered an approximate concentration of the analyte in the sample."
UJ - Data validation qualifier, "The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample."
R - Data validation qualifier, "The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified."

APPENDIX B

FIELD METHODS AND PROCEDURES AND STANDARD OPERATING PROCEDURES FROM THE TRUST'S QUALITY ASSURANCE PROJECT PLAN ("QAPP")

APPENDIX B
FIELD METHODS AND PROCEDURES

The field methods and procedures described herein are general descriptions of environmental sampling protocols employed by EKI. The methods described below are for environmental characterizations. To the extent practicable, the methods and procedures described below follow those detailed in Appendix 5, Standard Operating Procedures ("SOP") of the Presidio-Wide Quality Assurance Project Plan and Sampling and Analysis Plan ("QAPP") (Tetra-Tech, 2001). Copies of the SOPs are attached for reference. Procedures not explicitly included in the main text or Appendix 5 of the QAPP are described below.

1. SOIL SAMPLING METHODS

1.1 General Soil Sample Collection Procedures

Discrete soil samples collected for laboratory analysis will be collected in accordance with protocols outlined in SOP 001 of the QAPP.

A sample label will be attached to the sample container. The label will include a unique sample identification number, the sample depth, the time, and the date when the sample was collected. Filled glass jars will be placed in zip-closure plastic bags. Collected soil samples will be transported to the analytical laboratory in a cooled container under chain-of-custody procedures. Soil samples may be obtained under this Field Sampling Plan ("FSP") from a hand auger, shovel, or trowel. Methods and procedures related to the soil sample collection (including descriptions of decontamination procedures) are described in SOP 001 and SOP 014 of the QAPP.

2. SAMPLE HANDLING PROCEDURES

Each soil sample will be labeled and properly sealed immediately after collection. Sample tracking documents will be prepared so that sample handling and tracking can be controlled and followed. Forms and labels will be filled out with waterproof ink. Sample identification documents will include daily field logs, sample labels, and chain-of-custody records. Such records will be prepared as part of sampling activities.

Samples will be identified through use of site indicator codes, sample type codes, and sample numbers. The Site indicator codes will be MGB for Machine Gun Butt and the sample type code will be SB for soil boring. The MGB code will continue to be used to facilitate data management for all samples from this site. Previous sample locations included MGBSB01 through MGBSB19. Sample numbers for the scope of work described herein will begin at MGBSB101.

Samples will always be accompanied by a chain-of-custody record. When transferring samples to the analytical laboratory, the individuals relinquishing and the individuals receiving the samples will sign, date, and note the time on the chain-of-custody record. A separate chain-of-custody record will accompany each transfer of samples. The method of shipment and courier name will be entered on the chain-of-custody records.

3. FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality assurance/quality control ("QA/QC") of field sampling and laboratory analysis will be achieved in part through the analysis of field duplicate samples, which are intended to evaluate data precision.

QA/QC samples to be collected in the field are described and discussed in the sections below; laboratory QA/QC procedures are described in the Trust's QAPP. Field personnel will review QA/QC procedures with the Project Manager before mobilizing to the field.

3.1 Field Duplicate Samples

Field duplicate samples are QA/QC samples that are collected in series from the same location using the same sampling method. Both samples are submitted to the laboratory for analysis. One field duplicate soil sample will be collected, submitted, and analyzed for every 10 soil samples obtained.

SOP APPROVAL FORM

THE PRESIDIO TRUST
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SOIL SAMPLING

SOP NO. 001
REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 JAN 01
Date

1.0 BACKGROUND

Soil sampling is conducted for three main reasons. First, samples can be obtained for laboratory chemical analysis. Second, samples can be obtained for laboratory physical analysis. Third, samples can be obtained for visual classification and field screening. These three sampling objectives can be achieved separately or in combination with each other. Sampling locations are typically chosen to provide chemical, physical, or visual information in both the horizontal and vertical directions. A sampling and analysis plan is used to outline sampling methods and provide preliminary rationale for sampling locations. Sampling locations may be adjusted in the field based on the screening methods being used and the physical features of the area.

1.1 PURPOSE

Soil sampling is conducted to determine the chemical, physical, and visual characteristics of surface and subsurface soils.

1.2 SCOPE

This standard operating procedure (SOP) describes procedures for soil sampling in different areas using various implements. It includes procedures for test pit, surface soil, and subsurface soil sampling, and describes eight devices. It also discusses procedures for collecting soil samples for volatile organic compound (VOC) analysis using the EnCore™ soil sampler system.

1.3 DEFINITIONS

Hand Auger: Instrument attached to the bottom of a length of pipe that has a crossarm or "T"-handle at the top. The auger can be closed-spiral or open-spiral.

Bucket Auger: A type of auger that consists of a cylindrical bucket 10 to 72 inches in diameter with teeth arranged at the bottom.

Core Sampler: Thin-wall cylindrical metal tube with diameter of 0.5 to 3 inches, a tapered nosepiece, a T-handle to facilitate sampler deployment and retrieval, and a check valve (flutter valve) in the headpiece.

Spatulas or Spoons: Stainless steel instruments for collecting loose unconsolidated material.

Trier: Tube cut in half lengthwise with a sharpened tip that allows for collection of sticky solids or loosening of cohesive soils.

Trowel: Tool with a scooped blade 4 to 8 inches long and 2 to 3 inches wide and has a handle.

Split-Spoon (or Split-Barrel) Sampler: Thick-walled steel tube that is split lengthwise. A cutting shoe is attached to the lower end; the upper end contains a check valve and is connected to drill rods.

Thin-Wall Tube Sampler: Steel tube (1 to 3 millimeters thick) with tapered bottom edge for cutting. The upper end is fastened to a check valve that is attached to drill rods.

1.4 REFERENCES

Barth, D.S., and B.J. Mason. 1984. "Soil Sampling Quality Assurance Users Guide." EPA 600/4-84-043.

DeVara, E.R., B.P. Simmons, R.D. Stephens, and D.L. Storm. 1980. "Samplers and Sampling Procedures for Hazardous Waste Streams." EPA 600/2-80-018. January.

Mason, B.J. 1983. "Preparation of Soil Sampling Protocol: Techniques and Strategies." EPA 600/4-83-020.

U.S. Environmental Protection Agency (EPA). 1987. "A Compendium of Superfund Field Operations Methods." Office of Solid Waste and Emergency Response Directive 9355.0-14 (EPA/540/P-87/001).

EPA. 1991. "Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells." EPA/600/4-89/034. March.

EPA. 1994. "Soil Sampling." Environmental Response Team SOP No. 2012. Revision No. 0.0. November 16. (On-Line Address: http://www.ert.org/media_resrcs/media_resrcs.asp.)

1.5 REQUIREMENTS AND RESOURCES

Soil sampling requires that one or more of the following types of equipment be used:

Sampling Equipment	Other Required Equipment
Spoons and spatulas	Sample containers, labels, and chain-of-custody forms
Trowel	Logbook
Shovel or spade	Measuring tape
Trier	Soil classification guidelines
Core sampler	Wax for sealing ends of thin-wall tube

Hand auger	Plastic sheeting
Bucket auger	Decontamination equipment
Split-spoon	Drilling equipment
Thin-wall tube	Backhoe
	Health and safety equipment

2.0 PROCEDURES

This SOP presents procedures for conducting test pit, surface soil, and subsurface soil sampling. The project-specific field sampling plan will specify which of the following procedures will be used.

Soil samples for chemical analysis should be collected in the following order: (1) VOCs, (2) semivolatile organic compounds, and (3) metals. Once the chemical samples have been containerized, samples for physical analyses can be containerized. Typical physical analyses conducted include (1) grain size distribution, (2) moisture content, (3) saturated permeability, (4) unsaturated permeability, and (5) Atterberg limits. Additionally, visual descriptions of samples, using the Unified Soil Classification System (USCS), should be recorded. Soil samples for chemical analyses can be collected either as grab samples or composite samples. A grab sample is collected from a discrete location or depth. A composite sample consists of soil combined from more than one discrete location. Typically, composite samples consist of soil obtained from several locations and homogenized in a stainless steel or Teflon® pan or tray. Samples for VOC analysis should not be composited.

2.1 TEST PIT SOIL SAMPLING

Test pit soil sampling is conducted when a complete soil profile is required or as a means of locating visually detectable contamination or sources, such as debris and underground storage tanks. This type of sampling provides a detailed description of the soil profile and allows for multiple samples to be collected from specific soil horizons. Before conducting any test pit or trench excavation with a backhoe, the sampling team should ensure that the sampling area is clear of utility lines, subsurface pipes, and poles. Any intrusive activities require Trust project review and permit issuance.

A test pit or trench is excavated by incrementally removing soil material with a backhoe bucket. The excavated soil may be placed on plastic sheeting (or other means of segregation), well away from the edge of the test pit. A test pit with depths greater than 4 feet must have its walls properly stabilized

according to Occupational Safety and Health Administration standards if personnel access to the pit is required. In many applications, sampling from the backhoe bucket will be preferred.

Personnel entering the test pit may be exposed to toxic or explosive gases and oxygen deficient environments. Air monitoring is required before entering the test pit and the use of appropriate respiratory gear and protective clothing is mandatory. At least two persons must be present at the test pit before sampling personnel enter the excavation and begin soil sampling.

Test pits are not practical for depths greater than 15 feet. If soil samples are required from depths greater than 15 feet, samples should be obtained using test borings instead of test pits. Test pits are also usually limited to a few feet below the water table. In some cases, a pumping system may be required to control the water level within the pits.

Access to open test pits should be restricted by use of flagging, tape, or fencing. If a fence is used, it should be erected at least 6 feet from the perimeter of the test pit. The test pit should be backfilled as soon as possible after sampling is completed.

Soil samples can be collected from the walls or bottom of a test pit using various equipment. A hand auger, bucket auger, or core sampler can be used to obtain samples from various depths. A trier, trowel, or spoons can be used to obtain samples from the walls or pit bottom surface.

2.2 SURFACE SOIL SAMPLING

The surface (and near surface) soil sampling equipment presented in this SOP is best suited for sampling to depths of 0 to 6 feet below ground surface (bgs). The sample depth, sample analyses, soil type, and soil moisture will also dictate the best-suited sampling equipment. Before sample collection, the sampling locations should be cleared of any surface debris such as twigs, rocks, and litter. The following table presents various surface soil sampling equipment and their effective depth ranges, operating means (manual or power), and sample types collected (disturbed or undisturbed).

Sampling Equipment	Effective Depth Range (feet bgs)	Operating Means	Sample Type
Hand Auger	0 to 6	Manual	Disturbed
Bucket Auger	0 to 4	Power	Disturbed
Core Sampler	0 to 4	Manual or Power	Undisturbed

Shovel	0 to 6	Manual	Disturbed
Trier	0 to 1	Manual	Disturbed
Trowel	0 to 1	Manual	Disturbed
Spoon/Spatula	0 to 0.5	Manual	Disturbed

The procedures for using these various types of sampling equipment are discussed below.

2.2.1 Hand Auger

A hand auger equipped with extensions and a T-handle is used to obtain samples from a depth of up to 6 feet below ground surface. If necessary, a shovel may be used to excavate the topsoil to reach the desired subsoil level. If topsoil is removed, its thickness should be recorded. Samples obtained using a hand auger are disturbed in their collection; determining the exact depth at which samples are obtained is difficult.

The hand auger is screwed into the soil at an angle of 45 to 90 degrees from horizontal. When the entire auger blade has penetrated soil, the auger is removed from the soil by lifting it straight up without turning it, if possible. If the desired sampling depth has not been reached, the soil is removed from the auger and deposited onto plastic sheeting. This procedure is repeated until the desired depth is reached and the soil sample is obtained. The auger is then removed from the boring and the soil sample is collected directly from the auger into an appropriate sample container.

2.2.2 Bucket Auger

A bucket auger, equipped similarly as the hand auger, is used to obtain disturbed samples from a depth of up to 4 feet. A bucket auger should be used when sampling stony or dense soil that prohibits the use of a hand-operated core or screw auger. A bucket auger with closed blades is used in soil that cannot generally be penetrated or retrieved by a core sampler.

The bucket auger is rotated while downward pressure is exerted until the bucket is full. The bucket is then removed from the boring, the collected soil is placed on plastic sheeting, and this procedure is repeated until the appropriate depth is reached and a sample is obtained. The bucket is then removed from the boring and the soil sample is transferred from the bucket to an appropriate sample container.

2.2.3 Core Sampler

A hand-operated core sampler (Figure 1), similarly equipped as the hand auger, is used to obtain samples from a depth of up to 4 feet in uncompacted soil. The core sampler is capable of retrieving undisturbed soil samples and is appropriate when low concentrations of metals or organics are of concern. The core sampler should be constructed of stainless steel. A polypropylene core sampler is generally not suitable for sampling dense soils or sampling at an appreciable depth.

The core sampler is pressed into the soil at an angle of 45 to 90 degrees from horizontal and is rotated when the desired depth is reached. The core is then removed, and the sample is placed into an appropriate sample container.

2.2.4 Shovel

A shovel may be used to obtain large quantities of soil that are not readily obtained with a trowel but is not recommended. A shovel is used when soil samples from a depth of up to 6 feet are to be collected by hand excavation; a tiling spade (sharpshooter) is recommended for excavation and sampling. A standard steel shovel may be used for excavation; either a stainless steel or polypropylene shovel may be used for sampling. Soil excavated from above the desired sampling depth should be stockpiled on plastic sheeting. Soil samples should be collected from the shovel and placed into the sample container using a stainless-steel scoop, plastic spoon, or other appropriate tool.

2.2.5 Trier

A trier (Figure 2) is used to sample soil from a depth of up to 1 foot. A trier should be made of stainless steel or polypropylene. A chrome-plated steel trier may be suitable when samples are to be analyzed for organics and heavy metal content is not a concern.

Samples are obtained by inserting the trier into soil at an angle of up to 45 degrees from horizontal. The trier is rotated to cut a core and is then pulled from the soil being sampled. The sample is then transferred to an appropriate sample container.

2.2.6 Trowel

A trowel is used to obtain surface soil samples that do not require excavation beyond a depth of 1 foot. A trowel may also be used to collect soil subsamples from profiles exposed in test pits. Use of a trowel is practical when sample volumes of approximately 1 pint (0.5 liter) or less are to be obtained. Excess soil should be placed on plastic sheeting until sampling is completed. A trowel should be made of stainless steel (or galvanized steel for samples that are analyzed for metals). It can be purchased from a hardware or garden store. Soil samples to be analyzed for organics should be collected using a stainless steel trowel. Samples may be placed directly from the trowel into sample containers.

2.3 SUBSURFACE SOIL SAMPLING

Subsurface soil sampling, in conjunction with borehole drilling, is required for soil sampling from depths greater than approximately 6 feet. Subsurface soil sampling is frequently coupled with exploratory boreholes or monitoring well installation. Refer to SOP No. 004 for monitoring well installation and borehole drilling procedures. Prior to intrusive soil sampling activities, site utilities may be required to be cleared by a qualified utility locator. As noted previously, intrusive soil activities also require Trust project review and permit issuance.

Subsurface soil sampling may be conducted using a drilling rig or power auger. Selection of sampling equipment depends upon geologic conditions and the scope of the sampling program. Two types of samplers used with machine-driven augers—the split-spoon sampler and the thin-wall tube sampler—are discussed below. All sampling tools should be cleaned before and after each use in accordance with SOP No. 014 (General Equipment Decontamination). Both the split-spoon sampler and the thin-wall tube sampler can be used to collect undisturbed samples from unconsolidated soils. Direct-push methods are commonly used to drive tube samplers equipped with acetate or brass sleeves. Acetate sleeves permit the recovery of a continuous core (typically 4-foot lengths) that can be divided for chemical or other analyses. The procedures for using the split-spoon and thin-wall tube samplers are presented below.

2.3.1 Split-Spoon Sampler

Split-spoon samplers are available in a variety of types and sizes. Site conditions and project needs (such as large sample volume for multiple analyses) determine the specific type of split-spoon sampler to be used. Figure 3 shows a generic split-spoon sampler.

The split-spoon sampler is advanced into the undisturbed soil beneath the bottom of the casing or borehole using a weighted hammer and a drill rod. The relationship between hammer weight, hammer drop, and number of blows required to advance the split-spoon sampler in 6-inch increments indicates the density or consistency of the subsurface soil. After the split-spoon sampler has been driven to its intended depth, it should be removed carefully to avoid loss of sample material. In noncohesive or saturated soil, a catcher or basket should be used to help retain the sample.

After the split-spoon sampler is removed from the casing, it is detached from the drill rod and opened. If VOC samples are to be collected, EnCore™ samplers should be filled with soil taken directly from the split-spoon sampler (see Section 2.4). Samples for other specific chemical analyses should be taken as soon as the VOC sample has been collected. The remainder of the recovered soil can then be used for visual classification of the sample and containerized for physical analysis. The entire sample (except for the top several inches of possibly disturbed material) is retained for analysis or disposal.

2.3.2 Thin-Wall Tube Sampler

A thin-wall tube sampler, sometimes called the Shelby tube (Figure 4), may be pressed or driven into soil inside a hollow-stem auger flight, wash bore casing, or uncased borehole. The tube sampler is pressed into the soil without rotation to the desired depth or until refusal. If the tube cannot be advanced by pushing, it may be necessary to drive it into the soil without rotation using a hammer and drill rod. The tube sampler is then rotated to collect the sample from the soil and removed from the borehole.

After removal of the tube sampler from the drilling equipment, the tube sampler should be inspected for adequate sample recovery. The sampling procedure should be repeated until an adequate soil core is obtained (if sample material can be retained by the tube sampler). The soil core obtained should be documented in the logbook. Any disturbed soil is removed from each end of the tube sampler. If chemical analysis is required, VOC samples must be collected immediately after the tube sampler is withdrawn (see Section 2.4). Before use, and during storage and transport, the tube sampler should be capped with a nonreactive material. For physical sampling parameters, the tube sampler should be sealed by pouring three 0.25-inch layers of sealing liquid (such as wax) in each end, allowing each layer to solidify before applying the next. The remaining space at each end of the tube is filled with Ottawa sand or other, similar sand, which is allowed to settle and compact. Plastic caps are then taped over the ends of the tube. The top and bottom of the tube sampler should be labeled and the tube sampler should be stored accordingly.

2.4 ENCORE™ SOIL SAMPLER SYSTEM FOR VOC ANALYSES

The EnCore™ soil sampler system is a dedicated system designed to collect, store, and deliver an approximately 5- or 25-gram soil sample in a zero-headspace container. The samplers are applicable to the collection of samples for VOC analyses (including chlorinated and aromatic VOCs and purgeable total petroleum hydrocarbons). No preservation chemicals are needed in the field. Extrusion and extraction of the whole sample in the sampler is done in the laboratory. No subsampling of the individual container is necessary. The EnCore™ sampler is a single use device and cannot be cleaned or reused. The EnCore™ system consists of the following four components:

- A cartridge with moveable plunger
- A cap with two locking arms
- A T-handle to aid in sampling
- An extrusion handle used in the laboratory

The soil collected in the EnCore™ sampler is stored in a sealed, headspace-free state. Three Viton "O"-rings achieve the seals (two located on the plunger and one on the cap of the sampler). For correct sealing, these O-rings must not be removed or disturbed.

The following procedures should be followed to collect a soil sample with the EnCore™ sampler:

- Before collecting the sample, hold the coring body and push the plunger rod down until small rod rests against the tabs (to ensure that the plunger moves freely). Then, depress locking lever on T-handle and place the coring body, plunger end first, into the open end of the T-handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slot. Check to ensure sampler is locked in place.

- Turn the T-handle such that the "T" is up and the coring body is down. This position leaves the plunger body flush with the bottom of the coring body. Holding the T-handle, push and twist the sampler into the soil until the coring body is completely full. When the sampler is full, the small O-ring on the plunger rod will be centered in the T-handle viewing hole (the upper hole for the 25-gram sampler and the lower hole for the 5-gram sampler). Remove the sampler from the soil.

- Before capping the sampler, wipe excess soil from the coring body exterior, ridge area, and any soil that may protrude beyond the opening end of the coring body to ensure proper sealing. Cap the coring body while it is still on the T-handle. <u>Continue as above until three samples have been collected from the location</u>. If only VOCs are to be analyzed for a given location, a small jar (minimum 2 ounce) of sample must be collected to allow for moisture content analysis.

When sampling surface soils, apply the EnCore™ sampler to a freshly exposed soil surface, following the procedures described above. When sampling subsurface soils, EnCore™ samples should be collected from one of the open ends of a sleeve core immediately upon retrieval.

The EnCore™ sampling system cannot be reliably used as stated above to sample sand, loose soil, or sediment since a cohesive plug will not be formed with these materials. When working with these soils, pull the plunger all the way back and lock it. Turn the sampler upside down and scoop the material into the coring body and cap it. Make a note of this method deviation in the field notebook.

Place the three collocated samples for each VOC analysis into one zipper bag. Seal the bag, place it into a prechilled cooler maintained at 4°C, and ship the samples to the laboratory for preservation and analysis. The recommended holding time between sampling and preservation by the laboratory is 48 hours. The recommended holding time between preservation and analysis is 14 days. The laboratory will preserve two EnCore™ containers using sodium bisulfate and one container using methanol. This allows for both low-level and high-level analysis of the sample.

FIGURE 1

HAND-OPERATED CORE SAMPLER

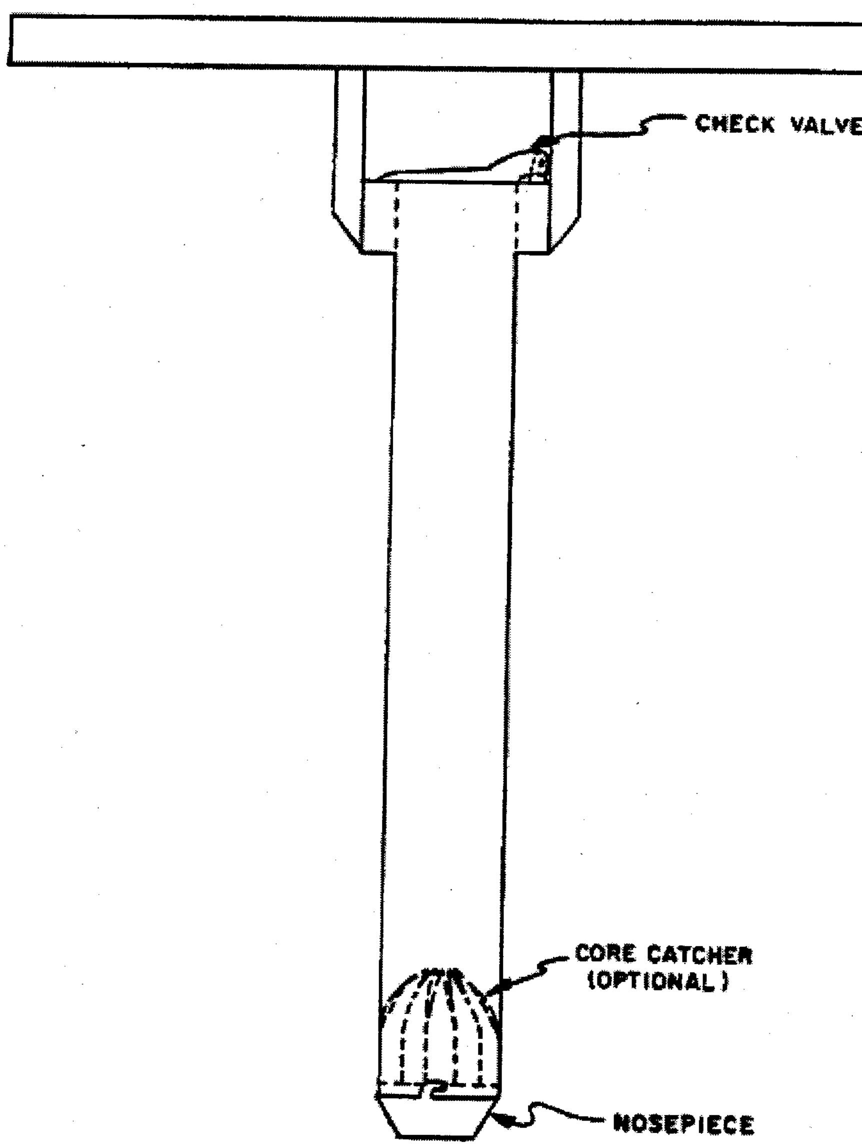


FIGURE 2

TRIER

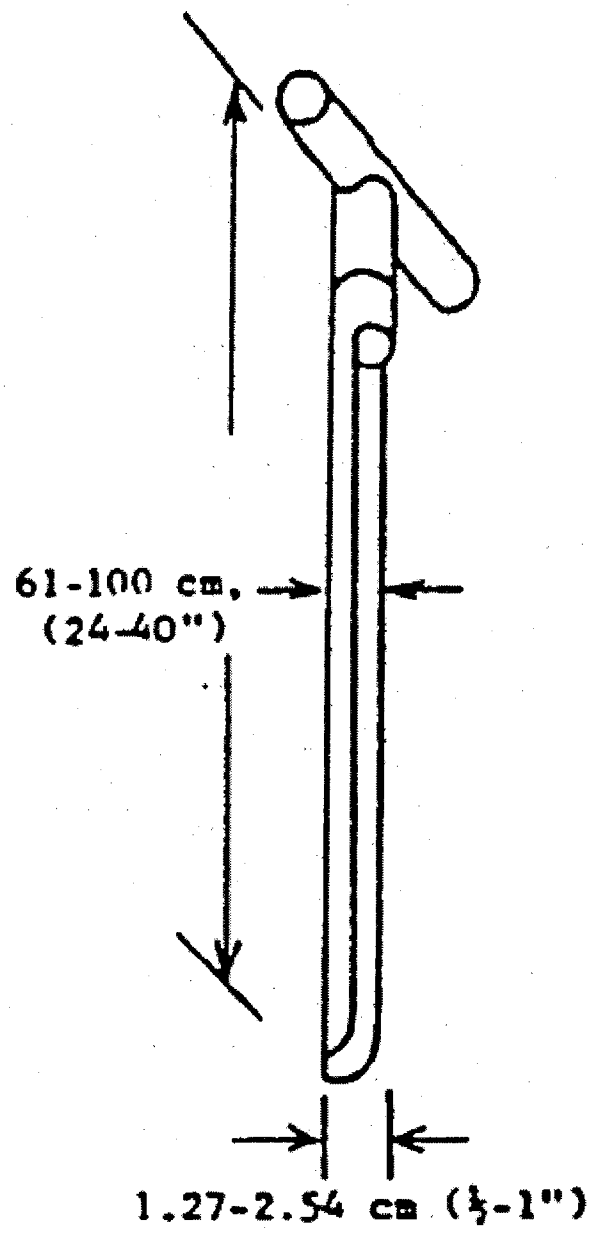


FIGURE 3

GENERIC SPLIT-SPOON SAMPLER

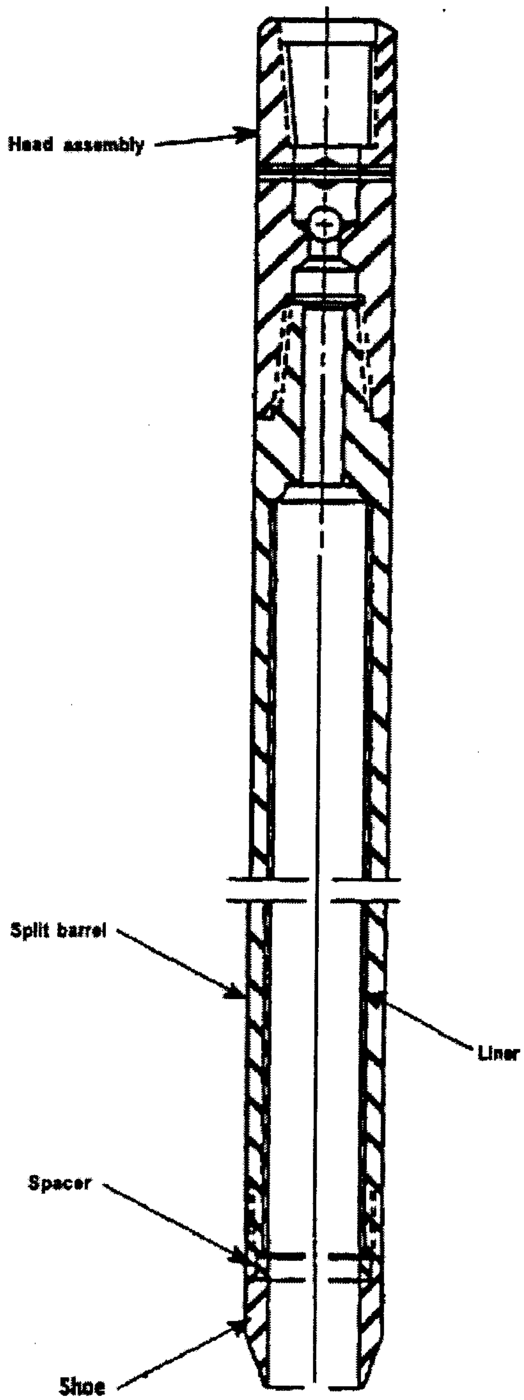
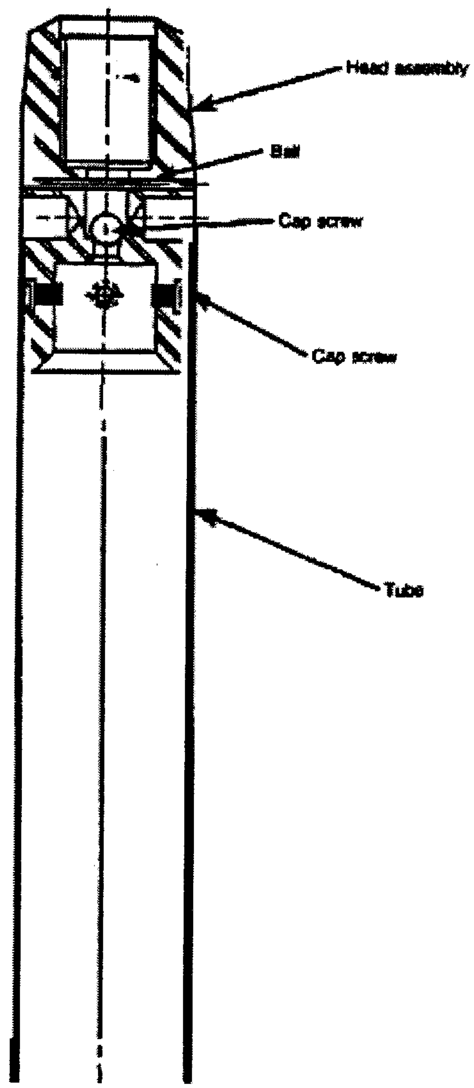


FIGURE 4

THIN-WALL TUBE SAMPLER



SOP APPROVAL FORM

THE PRESIDIO TRUST

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 014

REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 Jan 01

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Nonphosphate soap: Alconox® and Liquinox® are common laboratory grade products

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Groundwater Monitoring: Draft Technical Guidance." Office of Solid Waste and Emergency Response. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP No. 2006. Revision No. 0.0. August 11. (On-Line Address: http://www.ert.org/media_resrcs/media_resrcs.asp.)

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Nonphosphate soap
- Tap water

- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid
- Steam cleaner

2.0 PROCEDURES

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water-level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek® coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.
2. Wash outer gloves in Liquinox® or Alconox® solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.
3. Remove Tyvek® or coveralls. Containerize Tyvek® for disposal and place coveralls in plastic bag for reuse.
4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.
5. Remove disposable gloves and place them in plastic bag for disposal.
6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated before drilling operations begin, between borings, and at completion of the project. The locations for decontamination activities will be designated by the Trust project manager.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting. The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket, containing Liquinox® or Alconox® solution, using a stiff, long bristle brush.
2. Steam clean the sampling equipment over the rinsate tub and allow to air dry or rinse with deionized (distilled) water.
3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
4. Containerize all water and rinsate.
5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER-LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized (distilled) organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. If a steam cleaner is not available, to decontaminate a piece of equipment, use an Alconox® wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox® wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP APPROVAL FORM

THE PRESIDIO TRUST
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 015
REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 JAN 01
Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR) (*Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180) and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR).

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, and the HMR. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Chain of Custody: Document indicating custody of the samples at all times between sampling and analysis.

Custody Seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

Dangerous Goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 1999).

Environmental Samples: Environmental samples include drinking water, groundwater and surface water, soil, sediment, treated municipal and industrial wastewater effluent, and biological specimens. Environmental samples typically contain low concentrations of contaminants and when handled require only limited precautionary procedures.

Hazardous Materials Regulations: The HMRs are DOT regulations for the shipment of hazardous materials by air, water, and land; they are located in 49 CFR 106 through 180.

Hazardous Samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous Substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in Appendix A of 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in the appendix.

IATA Dangerous Goods Regulations: The DGRs are regulations that govern the international transport of dangerous goods by air. The DGRs are based on the International Civil Aviation Organization (ICAO) Technical Instructions. The DGR contain all of the requirements of the ICAO Technical Instructions and are more restrictive in some instances.

Nonhazardous Samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the DGR or HMR.

Overpack: An enclosure used by a single shipper to contain one or more packages and to form one handling unit (IATA 1999). For example, a cardboard box may be used to contain three fiberboard boxes to make handling easier and to save on shipping costs.

1.4 REFERENCES

U.S. Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (DOT and others). 1996. *1996 North American Emergency Response Guidebook.*

International Air Transport Association (IATA). 1997. *Guidelines for Instructors of Dangerous Courses.*

IATA. 1999. *Dangerous Goods Regulations.* 40th Edition.

U.S. Environmental Protection Agency. 1994. "Sampler's Guide to the Contract Laboratory Program." Office of Solid Waste and Emergency Response. Washington, DC. EPA/540/R-96/032. On-Line Address: http://www.epa.gov/oerrpage/superfund/programs/clp/guidance.htm - sample

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other noncombustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill
- Resealable plastic bags for sample jars and ice

- Tape (strapping and clear)
- Appropriate shipping containers, as specified in the DGR
- Labels that apply to the shipment such as hazard labels, address labels, "Cargo Aircraft Only" labels, and package orientation labels (up arrows)

2.0 PROCEDURES

The following procedures apply to packing and shipping nonhazardous and hazardous samples.

2.1 SAMPLE CLASSIFICATION

Prior to sample shipment by air courier, it must be determined whether the sample is subject to the DGR. Samples subject to these regulations shall be referred to as hazardous samples. Any airline belonging to IATA must follow the DGR. As a result, these air carriers **may not** accept a shipment that is packaged and labeled in accordance with the HMR (although in most cases, the packaging and labeling would be the same for either set of regulations). The HMR states that a hazardous material may be transported by aircraft in accordance with the ICAO Technical Instruction (49 CFR 171.11) upon which the DGR is based. Therefore, the use of the DGR for samples to be shipped by air complies with the HMR, but not vice versa.

Most environmental samples are not hazardous samples and do not need to be packaged in accordance with any regulations. Hazardous samples are those samples that can be classified as specified in Section 3 of the DGR, can be found in the List of Dangerous Goods in the DGR in bold type, are considered a hazardous substance (see definition), or are mentioned in "Section 2 - Limitations" of the DGR for countries of transport or airlines (such as FedEx). The hazard classifications specified in the DGR (and the HMR) are as follows:

Class 1 – Explosives

Division 1.1 – Articles and substances having a mass explosion hazard
Division 1.2 – Articles and substances having a projection hazard but not a mass explosion hazard
Division 1.3 – Articles and substances having a fire hazard, a minor blast hazard, and/or a minor projection hazard but not a mass explosion hazard
Division 1.4 – Articles and substances presenting no significant hazard
Division 1.5 – Very sensitive substances mass explosion hazard

Division 1.6 – Extremely insensitive articles, which do not have a mass explosion hazard

Class 2 – Gases

Division 2.1 – Flammable gas

Division 2.2 – Nonflammable, nontoxic gas

Division 2.3 – Toxic gas

Class 3 – Flammable Liquids

Class 4 – Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, when in Contact with Water, Emit Flammable Gases

Division 4.1 – Flammable solids

Division 4.2 – Substances liable to spontaneous combustion

Division 4.3 – Substances, when in contact with water, emit flammable gases

Class 5 – Oxidizing Substances and Organic Peroxide

Division 5.1 – Oxidizers

Division 5.2 – Organic peroxides

Class 6 – Toxic and Infectious Substances

Division 6.1 – Toxic substances

Division 6.2 – Infectious substances

Class 7 – Radioactive Material

Class 8 – Corrosives

Class 9 – Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger. Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a

flammable gas because it may contain a high percentage of methane. Class 3, flammable liquids, are based on the boiling point and flash point of a substance. Most class 3 samples include solvents, oil, gas, or paint-related material collected from drums, tanks, or pits. Division 6.1, toxic substances, is based on oral toxicity (LD_{50} [lethal dose that kills 50 percent of the test animals]), dermal toxicity (LD_{50} values), and inhalation toxicity (LC_{50} [lethal concentration that kills 50 percent of the test animals] values). Division 6.1 substances include pesticides and cyanide. Class 7, radioactive material, is defined as any article or substance with a specific activity greater than 70 kiloBecquerels (kBq/kg) (0.002 [microCuries per gram [μCi/g]). If the specific activity exceeds this level, the sample should be shipped in accordance with Section 10 of the DGR. Class 8, corrosives, is based on the rate at which a substance destroys skin tissue or corrodes steel; they are not based on pH. Class 8 materials include the concentrated acids used to preserve water samples. Preserved water samples are not considered class 8 substances and should be packaged as nonhazardous samples. Class 9, miscellaneous dangerous goods, is substances that present a danger, but are not covered by any other hazard class. Examples of class 9 substances include asbestos, polychlorinated biphenyls (PCB), and dry ice.

Unlike the DGR, the HMR includes combustible liquids in hazard class 3. The definition of a combustible liquid is specified in 49 CFR 173.120 of the HMR. The HMR has an additional class, ORM-D, which is not specified in the DGR. "ORM-D material" refers to a material such as a consumer commodity, which although otherwise subject to the HMR, presents a limited hazard during transport due to its form, quantity, and packaging. It must be a material for which exceptions are provided in the table of 49 CFR 172.101. The DGR lists consumer commodities as a class 9 material.

In most instances, the hazard of a material sampled is unknown because no laboratory testing has been conducted. A determination as to the suspected hazard of the sample must be made using knowledge of the site, field observations, field tests, and other available information.

According to 40 CFR 261.4(d) and (e), samples transported to a laboratory for testing or treatability studies, including samples of hazardous wastes, are **not** hazardous wastes. Air carriers will not accept a shipment of hazardous waste.

2.2 PACKAGING NONHAZARDOUS SAMPLES

Nonhazardous samples, after being appropriately containerized, labeled, and tagged, should be packaged in the following manner.

1. Place the sample in a resealable plastic bag.

2. Place the bagged sample in a cooler and pack it to prevent breakage.

3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.

4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.

5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.

6. Tape any instructions for returning the cooler to the inside of the lid.

7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.

8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.

9. Place address labels on the outside of the cooler, if samples are to be shipped by a commercial carrier.

2.2 PACKAGING HAZARDOUS SAMPLES

Packaging of hazardous samples should only be performed by individuals with DOT shipping training. The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR references. The HMR must be followed only if shipping hazardous samples by ground transport.

1. Determine the proper shipping name for the material to be shipped. All proper shipping names are listed in column B of the List of Dangerous Goods table in Section 4 of the DGR (or column 2 of the Hazardous Materials Table in 49 CFR 172.101). In most instances, a generic name based on the hazard class of the material is appropriate. For example, a sample of an oily liquid collected from a drum with a high photoionization detector (PID) reading should be packaged as a flammable liquid. The proper shipping name chosen for this sample would be "flammable liquid, n.o.s." The abbreviation "n.o.s." stands for "not otherwise specified" and is used for generic shipping names. Typically, a specific name, such as acetone, should be inserted in parentheses after most n.o.s. descriptions. However, a technical name is not required when shipping a sample for testing purposes and the components are not known. If shipping a hazardous substance (see definition), then the letters "RQ" must appear in front of the proper shipping name.

2. Determine the United Nations (UN) identification number, class or division, subsidiary risk if any, required hazard labels, packing group, and either passenger aircraft or cargo aircraft packing instructions based on the quantity of material being shipped in one package. This information is provided in the List of Dangerous Goods (or Hazardous Materials Table in 49 CFR 172.101) under the appropriate proper shipping name. A "Y" in front of a packing instruction indicates a limited quantity packing instruction. If shipping dry ice or a limited quantity of a material, then UN specification shipping containers do not need to be used.

3. Determine the proper packaging required for shipping the samples. Except for limited quantity shipments and dry ice, these UN specification packages have been tested to meet the packing group of the material being shipped. Specific testing requirements of the packages are listed in Section 6 of the DGR (or 49 CFR 178 of the HMR). All UN packages are stamped with the appropriate UN specification marking. Prior planning is required to have the appropriate packages on hand during a sampling event where hazardous samples are anticipated. Most samples can be shipped in either a 4G fiberboard box, a 1A2 steel drum, or a 1H2 plastic drum. Drums can be purchased in 5- and 20-gallon sizes and are ideal for shipping multiple hazardous samples. When FedEx is used to ship samples containing PCBs, the samples must be shipped in an inner metal packaging (paint can) inside a 1A2 outer steel drum. This method of packaging PCB samples is in accordance with FedEx variation FX-06, listed in Section 2 of the DGR.

4. Place each sample jar in a separate resealable plastic bag. Some UN specification packages contain the sample jar and plastic bag to be used when shipping the sample.

5. Place each sealed bag inside the approved UN specification container (or other appropriate container if a limited quantity or dry ice) and pack with enough noncombustible, absorbent, cushioning material (such as vermiculite) to prevent breakage and to absorp liquid.

6. Place chain-of-custody forms in a resealable plastic bag and either attach it to the inside lid of the container or place it on top inside the container. Place instructions for returning the container to the shipper on the inside lid of the container as appropriate. Close and seal the shipping container in the manner appropriate for the type of container being used.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packaging must be marked with proper shipping name, UN identification number, and name and address of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. Air carriers generally supply a their own Dangerous Goods Airbill to their customers; the airbill typically combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply

- The nature and quantity of dangerous goods. This includes the following information in the following order (obtained from the List of Dangerous Goods in the DGR): proper shipping name, class or division number, UN identification number, packing group number, subsidiary risk, quantity in liters or kilograms (kg), type of packaging used, packing instructions, authorizations, and additional handling information. Authorizations include the words "limited quantity" or "LTD. QTY." if shipping a limited quantity, any special provision numbers listed in the List of Dangerous Goods in the DGR, and the variation "USG-14" when a technical name is required after the proper shipping name but not entered because it is unknown.

- Signature for the certification statement

- Name and title of signatory

- Place and date of signing certification

- A 24-hour emergency response telephone number for use in the event of an incident involving the dangerous good

- Emergency response information attached to the shipper's declaration. This information can be in the form of a material safety data sheet or the applicable North American Emergency Response Guidebook (NAERG; DOT 1996) pages. Figure 3 depicts the appropriate NAERG emergency response information for "Flammable liquids, n.o.s." as an example.

Note that dry ice does not require an attached shipper's declaration. However, the air waybill must include the following on it: "Dry ice, 9, UN1845, ____ x ____ kg." The blanks must include the number of packages and the quantity in kg in each package. If using FedEx to ship dry ice, the air waybill includes a box specifically for dry ice. Simply check the appropriate box and enter in the number of packages and quantity in each package.

The HMR requirements for shipping papers are located in 49 CFR 172 Subpart C.

3.0 POTENTIAL PROBLEMS

The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package, return the package, and if a dangerous good, inform the Federal Aviation Administration (FAA), which can result in fines.

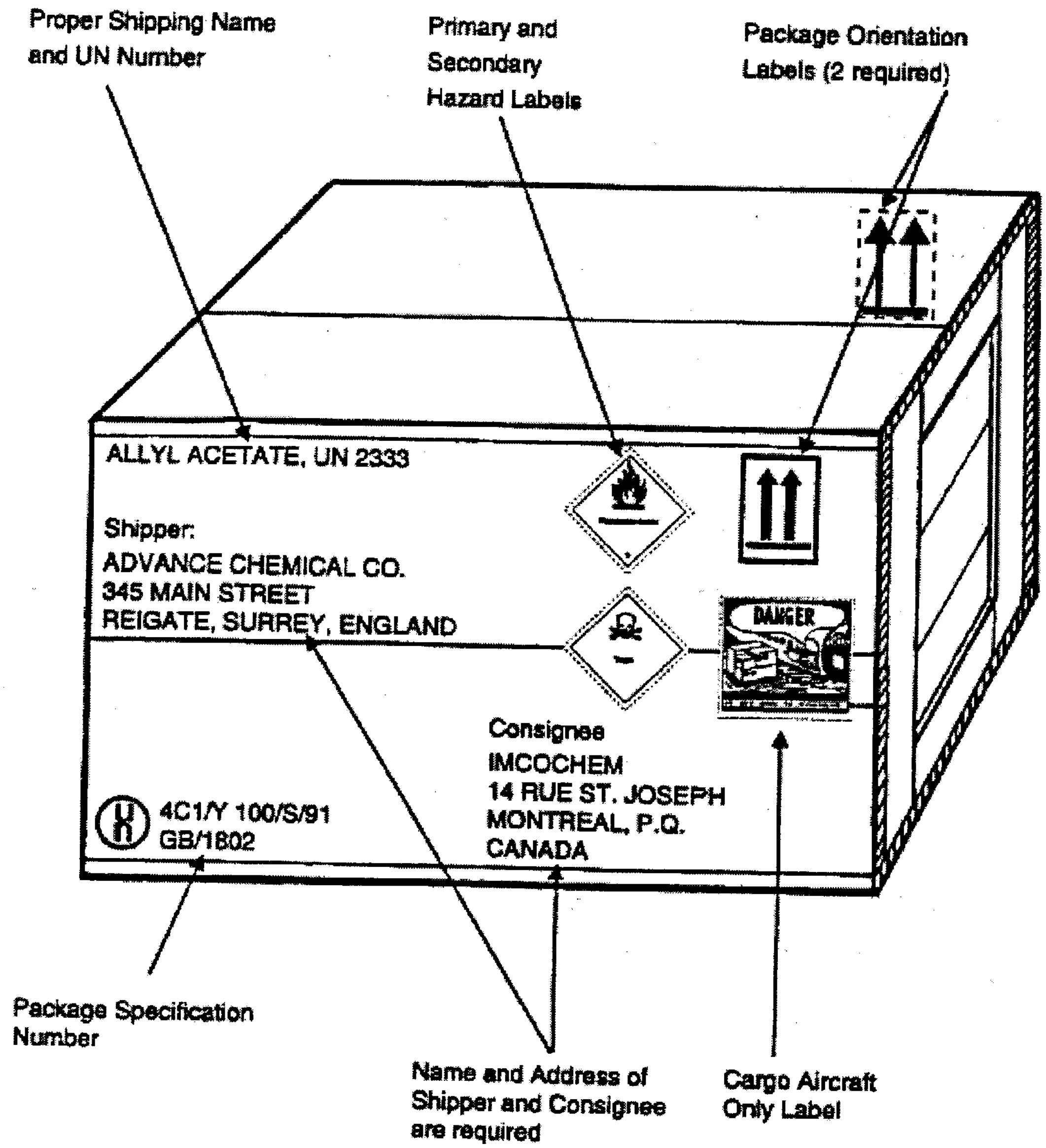
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment.

- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact the air carrier with questions about dangerous goods shipments and ask for a dangerous goods expert.

FIGURE 1

EXAMPLE OF A CORRECTLY MARKED AND LABELED DANGEROUS GOODS PACKAGE



Source: International Air Transport Association (IATA). 1997.

FIGURE 2

EXAMPLE OF A DANGEROUS GOODS AIRBILL

FedEx *Dangerous Goods Airbill* Sender's Copy

The World On Time.

11729489

1 From

Date FILL IN Sender's FedEx Account Number 1788-8C14-4

Sender's Name FILL IN Phone (312) 856 6700

Company TETRA TECH EM INC

Address 200 E RANDOLPH ST STE 4700

City CHICAGO State IL ZIP 60601

2 Your Internal Billing Reference FILL IN

3 To

Recipient's Name FILL IN Phone ( )

Company

Address

City State ZIP

For HOLD at FedEx Location check here: Hold Weekday / Hold Saturday

For WEEKEND Delivery check here: Saturday Delivery / Sunday Delivery

4a Express Package Service Packages up to 150 lbs.

[X] FedEx Priority Overnight [ ] FedEx Standard Overnight [ ] FedEx 2Day [ ] FedEx Express Saver

4b Express Freight Service Packages over 150 lbs.

[ ] FedEx 1Day Freight [ ] FedEx 2Day Freight [ ] FedEx 3Day Freight

Questions? Call 1-800-Go-FedEx (800-463-3339) or Visit our Web site at www.fedex.com

5 Packaging

[X] Other Packaging

Dangerous Goods cannot be shipped in FedEx packaging.

6 Special Handling

[X] Dangerous Goods As per attached Shipper's Declaration [ ] Cargo Aircraft Only

7 Payment

[X] Sender [ ] Recipient [ ] Third Party [ ] Credit Card [ ] Cash/Check

Total Packages Total Weight Total Declared Value $ .00

Signature Release Unavailable

374

FedEx Tracking Number 813350883058 Form I.D. No. 0204

Page 1 of 1 Pages

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: (delete non-applicable) PASSENGER AND CARGO AIRCRAFT / ~~CARGO AIRCRAFT ONLY~~

Airport of Departure: Chicago

Airport of Destination: "City sending sample to"

Shipment type: (delete non-applicable) NON-RADIOACTIVE ~~RADIOACTIVE~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Proper Shipping Name	Class or Division	UN or I.D. No.	Packing Group	Subsidiary Risk	Quantity and Type of Packaging	Packing Inst.	Authorization
Flammable liquid, n.o.s.	3	UN 1993	III	—	4 glass jars in a 1A2 steel drum Net Quantity = 4 L	309	A3 USG-14

Additional Handling Information: NAERG# 128 Attached.

Prepared for AIR TRANSPORT according to: (Customer MUST check one) [ ] 49 CFR [X] ICAO/IATA

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked, and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Name/Title of Signatory: Me, Environmental Scientist

Place and Date: 200 E Randolph, Chicago, IL xx/xx/xx

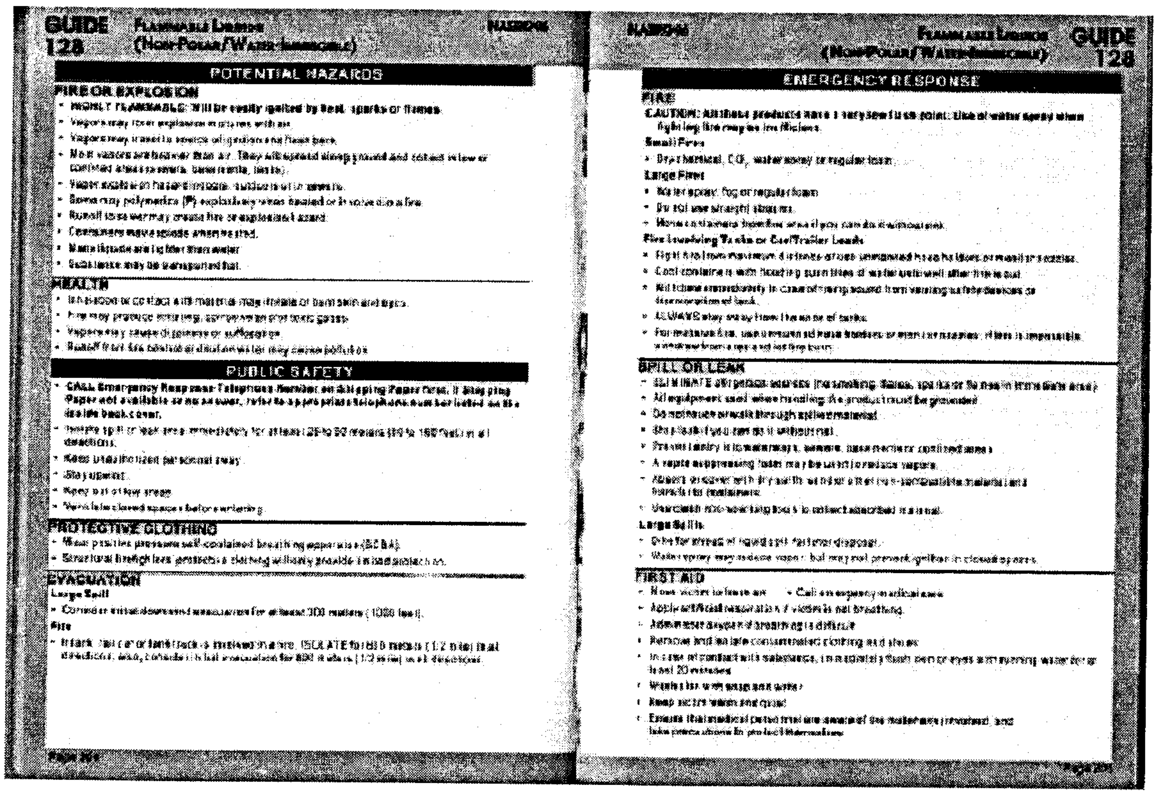
Signature: me

Emergency Telephone Number (Required for U.S. Origin or Destination Shipments): FILL IN

IF ACCEPTABLE FOR PASSENGER AIRCRAFT THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

FIGURE 3

**NAERG EMERGECY RESPONSE INFORMATION
FOR FLAMMABLE LIQUIDS, N.O.S.**



GUIDE 128

POTENTIAL HAZARDS

FIRE OR EXPLOSION

HEALTH

PUBLIC SAFETY

PROTECTIVE CLOTHING

EVACUATION

Large Spill

Fire

EMERGENCY RESPONSE

FIRE

Small Fires

Large Fires

Fire Involving Tanks or Car/Trailer Loads

SPILL OR LEAK

Large Spills

FIRST AID

Source: DOT and others. 1996.